Positioning Risk*

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(latest draft here)

Abstract

Risk profiles of individual assets vary with speculative positioning. hedge fund positions in currency futures strongly predict currency betas: currencies in which speculators hold long positions comove more positively with equity markets. The link emerges after the global financial crisis, when speculators and their intermediary counterparties commonly unwind their positions with equity market shocks. My findings suggest that the scaling of futures positions in response to equity market moves translates directly into an endogenous equity market risk exposure of the currency. Compared to previously studied patterns of endogenous risks and crowded trades, these risk externalities are harder to diversify across asset classes.

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When and why do assets comove? Beyond fundamental similarities, a large literature links the covariation of different asset classes to the role of financial intermediaries in different markets.[1] A second strand of literature following Kyle and Xiong (2001) connects the comovement of individual assets to common ownership and the price impact of synchronous trades.[2] Such price impact can be particularly consequential if the responsible synchronous trades occur at the same time as—or are prompted by—large moves in other asset prices. If large market shocks alter the willingness or ability of speculators to engage in highly levered and popular directional bets, then the assets involved in these bets inherit an endogenous exposure to such shocks.

I provide evidence that the price impact of hedge funds rescaling their positions affects the asset prices in even some of the most liquid markets we know: foreign exchange. The market for currency futures has two appealing properties as an empirical setting to study the linkages between positioning by different types of market participants and the assets' risk profiles: (i) futures positions are highly time-varying and observable by trader type at weekly frequencies, and (ii) volume is dominated by trades between speculators on one side and market-making intermediaries on the other.

Endogenous risk contributes to the recent increase in cross-sectional and time-series variation in currency betas. Since the onset of the global financial crisis (GFC), exchange rate exposures to equity market risk have become more volatile, both cross-sectionally and in the time series (see Figure 1 below). While one might expect an event like the GFC to dislocate risk profiles of all sorts of assets, these patterns have not reversed over the subsequent decade-long bull market.

Market participants conventionally label large market movements as "risk-off" or

[1]Following the theoretical work of He and Krishnamurthy (2013), recent empirical contributions include He et al. (2017), Haddad and Muir (2017), and Miranda-Agrippino and Rey (2019).

[2]Including, but not limited to, Barberis et al. (2005), Antón and Polk (2014), Gromb and Vayanos (2018), Kondor and Vayanos (2019), and Lou and Polk (2019).

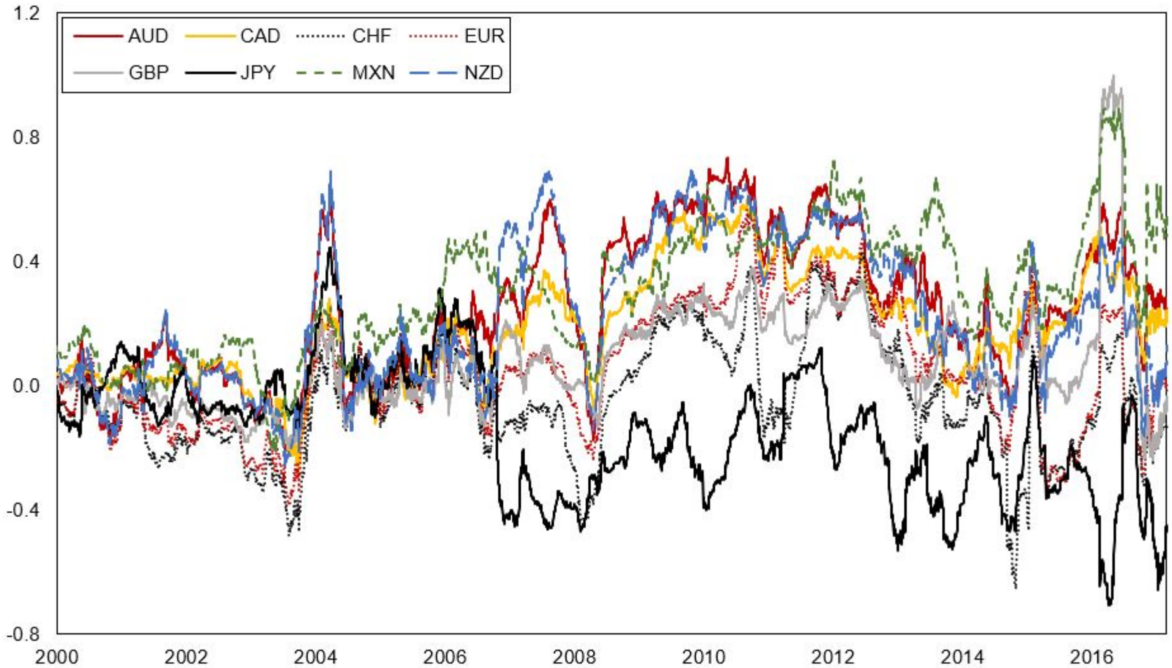

Figure 1: Currency betas against the US dollar over time. The plot shows the rolling slope coefficients from daily univariate regressions of dollar exchange rate changes on S&P 500 returns over a backward looking window of 90 trading days.

"risk-on" environments. In a risk-off market, equities and other risky assets suffer, while so-called safe-haven assets like US Treasuries, gold, or typically the Japanese yen gain. Such risk-off market moves commonly coincide with hedge funds and other speculators unwinding leveraged positions. In currency futures markets, the counterparty to these speculative positions is typically an intermediary, rather than another speculator or other unhedged agent. This pairing has implications for price impact: true to its name, the intermediary hedges the currency exposure from these futures positions in other markets, thereby 'transmitting' price pressure in futures to the spot market.

I show that, since the GFC, hedge funds reduce the scale of their currency futures positions when equity markets fall. Simultaneously, the intermediary counterparties unwind their futures positions along with the respective hedges. At times when a given currency trade is particularly popular among speculators, its unwinding can exert price pressure sufficient to temporarily dislocate spot exchange rates. An asset that is held long as part of the trade experiences selling pressure and depreciates as a result, and vice versa for assets held short. As a result, assets held long become positively correlated with equity markets and other risky assets.

As an illustrative example, consider the US dollar in 2014-2015, when many hedge funds were involved in a particular form of the carry trade, commonly referred to as the "divergence trade". This bet on diverging monetary policies between the Federal Reserve and the ECB involved a long position in the dollar against the euro. Over the course of 2015, the dollar—historically more of a safe-haven asset than the euro, that is, with negative beta—became positively correlated with equity markets. The euro, instead, started to behave like a "safe-haven" currency relative to the US dollar, and this was commonly attributed to reverting speculative flows out of the dollar and into the euro during particularly bad market times:

"Is the euro the new safe haven?"
(CNBC, August 2015)[3]

"The euro is looking like the yen—where money tends to come home when the world is a scary place"
(Société Générale, September 2015)

"The euro isn't a haven, but is acting like one because of its role in the carry trade. The distinction is important because it means the link will diminish as these positions, or shorts, are unwound."
(Pioneer Investments, September 2015)[4]

The literature on when and why such positions are unwound goes back to the seminal contributions of Long et al. (1990), Shleifer and Vishny (1997), and Gromb and

[3]cnbc.com/2015/08/24/is-the-euro-the-new-safe-haven.html

[4]independent.ie/business/world/euro-is-gaining-safehaven-status-among-traders-at-worst-time-for-draghi-31559999.html

Vayanos (2002). While even a long-only position may be fire-sold due to fund outflows (Coval and Stafford, 2007), levered strategies are particularly exposed to the risk of deteriorating funding conditions and increasing margin requirements, resulting in asset comovement (e.g., Brunnermeier and Pedersen, 2009; Bian et al., 2017; Kahraman and Tookes, 2019). I document that negative S&P returns are associated with unwinding of futures positions held by speculators and intermediaries across a sample of 8 currencies. This link does not exist for other institutional investors. In the post-crisis period, speculators' positions in these currencies predict stronger covariation with the S&P (more positive correlations and betas) at weekly horizons. These findings not only suggest that positions that are popular among speculators more commonly develop endogenous risk exposures, they also imply that these exposures are linked more closely to systematic market movements. As a result, they are less easily diversifiable, not only for the speculators themselves but for all other market participants that suffer from the speculator-imposed risk externality.

Identification a causal link between asset comovement and the unwinding of speculative positions runs into an obvious endogeneity problem: if covariation with the S&P is predictable and carries a risk premium, one would expect risk-tolerant market participants to load up on this risk. It is plausible that hedge funds are more inclined to do so than other institutional investors, such that their exposures predict betas. I present two results which contradict this interpretation.

Firstly, I find that the reverse of the predictability result does not hold: weekly changes in equity betas and correlations do not predict changes in positions, nor does the result arise during FOMC announcement weeks, when conditional risk exposures may be particularly easy to predict. Secondly, I find that a trading strategy that buys (sells) currencies that hedge funds have just sold (bought) during a fall in equity markets is profitable, with a Sharpe Ratio of up to 2. This result is inconsistent with the interpretation that price movements are prompted by exogenous variation in risk premia which hedge funds target more than other traders. Both results are, however, consistent with transitory price impact from forced unwinding.

Related literature.—Price impact of intermediated cross-currency flows is consistent with the theoretical work by Gabaix and Maggiori (2015): capital-constrained intermediaries require compensation for bearing exchange rate risk as counterparties to a net cross-currency flow. In equilibrium, investor positions have price impact if they are not balanced out by an opposing flow and require an intermediary counterparty.

My results relate closely to other work on endogenous risk, such as Cho (forthcoming). In the cross-section of equity anomaly portfolios, he finds that those strategies which attract long (short) hedge fund positions comove positively (negatively) with shocks to the leverage of the broker-dealers. I consider comovement with equity markets rather than with broker-dealer leverage (Adrian et al., 2014) for two reasons. Broker-dealer leverage is only reported quarterly, while futures positioning of hedge fund is observable weekly. This high frequency in observable positions allows me to consider the rich time-series dimension of the link between hedge fund trading and asset comovement, as long as the latter can be measured at similar frequencies. Further, I find that S&P returns correlate strongly with the unwinding of speculative futures positions. Examining comovement with equity markets allows my results to speak to the post-crisis divergence of currency betas and their increasingly relevant link to currency risk premia. Lilley and Rinaldi (2019) and Kremens and Martin (2019) show that the post-crisis equity market exposures line up with currency risk premia. Lilley and Rinaldi (2019) link the change in currency betas to a regime change in monetary policy responses to rising risk premia. I provide evidence in favor of a complementary mechanism responsible for higher variation in betas, particularly in the time series.

In a seminal and closely related paper, Brunnermeier et al. (2008) find that spikes in the VIX are associated with the unwinding of carry trade positions in currency futures and predict low carry trade returns. They also find that futures positions of "non-commercial traders" predict negative skewness in currency returns. Motivated by this observation, they link the profitability of the carry trade to its crash risk. The findings presented in this paper and the proposed explanation are closely related to this line of argument, but complement and differentiate it along two important dimensions.

Firstly, I examine currency risk through the lens of comovement with equity markets, rather than skewness. Changing the notion of risk amounts to more than just picking a different moment of the return distribution: Jurek (2014) shows that crash-hedged carry trades remain profitable. At the same time, equity market risk has been shown to explain currency risk premia (Campbell et al., 2010; Lettau et al., 2014; Kremens and Martin, 2019; Lilley and Rinaldi, 2019).[5] Showing that endogenous risk patters are systematic raises their economic relevance to a wide range of market participants including hedge funds (Duarte et al., 2007). I provide evidence that hedge funds not only price currency betas, but actively shape them at short horizons. Further, the result is new in the sense that it does not hold pre-crisis. Consistent with the absence of a link between positions and betas, the positions considered in Brunnermeier et al. (2008) do not unwind with negative equity market returns prior to the GFC.[6]

Secondly, I examine currency risk beyond the well-studied returns on the interest-rate-based carry trades or the dollar trade.[7] While hedge funds are *on average* long the high-interest currencies of Australia and New Zealand, and short the Japanese yen,

[5]An earlier literature also examines consumption risk rather than equity market risk as a source of currency risk premia (Lustig and Verdelhan, 2007; Verdelhan, 2010; Burnside, 2011).

[6]Prior to 2006, the CFTC only reports positions of "non-commercial traders" rather than separating "Leveraged Funds" (i.e., hedge funds) from other institutional investors. I find that out of those two subgroups, only hedge funds unwind positions with S&P declines, and that only their positions predict exchange rate comovement with those two indices.

[7]Hassan and Mano (2019) summarize the covariance between returns and interest differentials and unify the well-known associated stylized facts from regressions and portfolio-based approaches.

net speculative positioning varies considerably around those means in the post-crisis period. Hedge funds are short AUD in 34% of sample weeks (24% for NZD) since the start of 2010. Over the same period, they were long the yen and, respectively, the Swiss franc 40% and 48% of the time. Across the panel, the correlation of weekly hedge fund positions and interest rate differentials relative to the dollar is 0.13. The most common trade on interest differentials after the crisis appears to be the aforementioned "divergence trade", which—uncharacteristically for a carry trade—is long the dollar. Other popular trades, such as in the Mexican peso or the British pound, appear to be driven by political events rather than interest rates. The results in this paper shed a light on the impact of the vast amount of speculative trading on currency return distributions outside of conventional carry trades.

1 Data

I obtain currency futures positions from the U.S. Commodity Futures Trading Commission (CFTC) which reports weekly commitments of traders in financial futures traded on the Chicago Mercantile Exchange. The data span observations from June 2006 to June 2017 for USD futures and exchange rates versus eight currencies: Australian dollar (AUD), Canadian dollar (CAD), Swiss franc (CHF), euro (EUR), pound Sterling (GBP), Japanese yen (JPY), Mexican peso (MXN), and New Zealand dollar (NZD). Each exchange rate is expressed in terms of USD per unit of foreign currency, such that a positive net return reflects an appreciation of the respective currency against the dollar. The CFTC assigns traders to one of four groups:

1. "Dealer/Intermediary" (I will refer to these as *intermediaries*),

2. "Asset Manager/Institutional" (*institutional investors*),

3. “Leveraged Funds” (*hedge funds*),

4. “Other reportables” (*others*).

Group 1 includes large banks, which “typically [...] are dealers and intermediaries that earn commissions on selling financial products, capturing bid/offer spreads and otherwise accommodating clients.”[8] The second group contains “institutional investors, including pension funds, endowments, insurance companies, mutual funds and those portfolio/investment managers whose clients are predominantly institutional.” Group 3 includes hedge funds, and their strategies “involve taking outright positions”. These traders “may be engaged in [...] conducting proprietary futures trading and trading on behalf of speculative clients.” The final group (others), naturally, contains any remaining types of traders. These traders mostly use futures “to hedge business risk, whether that risk is related to foreign exchange, equities or interest rates, including [...] corporate treasuries, central banks, smaller banks, mortgage [and] credit unions”.

I denote by $nhf_{i,t}$ the net exposure—long positions minus short positions—of hedge funds to currency i versus the US dollar at time t. The net exposures of institutional investors and intermediaries are analogously denoted by $nii_{i,t}$ and $ndi_{i,t}$, respectively. I will also use a scaled version of this variable, denoted by $\widetilde{nhf}_{i,t} = nhf_{i,t}/oi_{i,t}$ (and analogously for nii and ndi), where $oi_{i,t}$ denotes the open interest in currency i reported by the CFTC. Table 1 reports all cross-correlations between the four groups.

The net positions of hedge funds and intermediaries are strongly negatively correlated ($\rho < -0.8$ irrespective of whether variables are in changes or levels, scaled or unscaled), suggesting that intermediaries act as counterparties for the directional bets of hedge funds. In contrast, institutional investors appear to account for a substantially smaller part of intermediaries' positions with a correlation of -0.43. This makes

[8]The full CFTC explanatory notes are available at
cftc.gov/idc/groups/public/@commitmentsoftraders/documents/file/tfmexplanatorynotes.pdf.

currency futures a particularly interesting laboratory to study the dynamics of speculative positions. Broker-dealers intermediate the speculators' demand for exposure to exchange rate movements and hedge the resulting futures positions in other markets. Beyond the strong correlation the two groups account for the vast majority of open interest in most USD currency futures.

To illustrate the logic of price impact in the spot market from changes in futures positions, Figure 2 depicts the schematic chain of flows across the two different currency markets in the "divergence trade". In the example, an investor enters into an unhedged

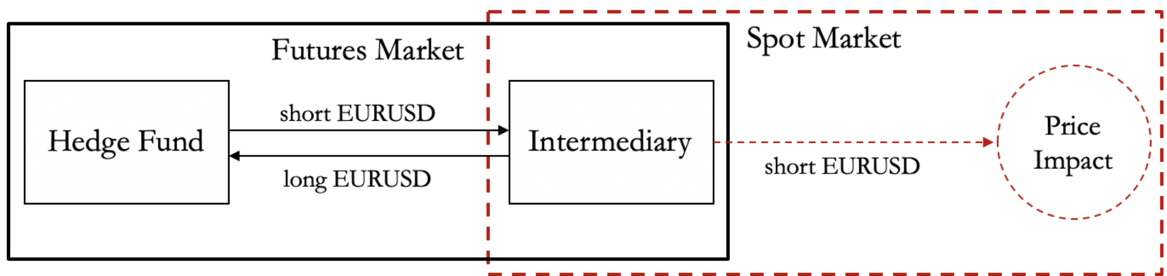

Figure 2: Schematic flows across FX markets

position in the futures market (short €, long \$). Since futures are in zero net-supply, the investor requires a counterparty, and if no other investor wants to take the opposite unhedged position, an intermediary will step in. The intermediary can then hedge its futures position (short \$, long €) with the opposite position in the spot market, where this flow may cause a spot depreciation of the euro. The reverse flow occurs when the speculator unwinds the original position. Price impact likely depends on the size of the flows hitting the market at any point in time, and will be particularly strong if many speculators are prompted to unwind similar, large positions at the same time. Counterparty behavior matters: the same positions in zero net-supply derivatives could be unwound between two unhedged speculators without ever touching the spot market.

Table 2 reports the average net position of all four groups by currency, along with the respective standard deviations. Group 4 ("Others") is by far the group with the smallest and least volatile positions for most currencies. Hedge funds and intermediaries account for the majority of trading in most currencies, but institutional investors hold average positions of notable size in some currencies, such as GBP, JPY, and MXN. The positions of all four groups are highly time-varying within-currency. The bottom three rows of each panel in Table 2 show that this time-series variation far outweighs the cross-sectional variation in the composition of the total panel variation. Figure 3 shows the scale and time-variation of each group visually (omitting group 4 for readability). The graphs show that hedge funds change from being net long to net short several times over the sample period for all currencies.

Prior to 2006, the CFTC reported positions in two groups, *commercial* and *non-commercial* traders, where the latter contains traders that do not explicitly report that "they manage their business risks by hedging in futures". These will likely include hedge funds and institutional investors, but potentially also some traders now classified as intermediaries or others. Over the time frame when both classifications are available, the key variables of interest, the net exposures of hedge funds, $nhf_{i,t}$, and of "non-commercial traders", $nnc_{i,t}$, are strongly correlated, with an average time-series correlation of around 0.9. I use the nnc and $\widetilde{nnc}$ variables over the period from 2000 to 2006 to compare these pre-crisis results to those arising since 2010.

2 Currency betas

To quantify the statistical link between time-varying currency betas and hedge fund positioning, I run time-series regressions of daily exchange rate movements on S&P returns and an interaction of S&P returns with $\widetilde{nhf}$. This variable captures the positioning of hedge funds scaled by open interest: it is positive when hedge funds are long, large when their positions account for a bigger portion of open interest, and bounded between -1 and 1. Denote by $r_t^{S\&P} = S\&P_t/S\&P_{t-1} - 1$ the return on the index from day $t-1$ to day t. As $\widetilde{nhf}$ is only observed weekly, I use the last available observation prior to day t to interact with the daily return. Introducing some further notation, I will denote by $r_{i,t} = e_{i,t}/e_{i,t-1} - 1$, the net currency return on currency i versus the US dollar $t-1$ to t. I decompose equity market risk into a constant baseline exposure, β_i^c and a time-varying exposure that is (statistically) explained by hedge fund positioning, the *positioning beta* β_i^p.

$$r_{i,t} = \alpha_i + \beta_i^c \cdot r_t^{S\&P} + \beta_i^p \cdot \widetilde{nhf}_{i,t-1} \cdot r_t^{S\&P} + \gamma \widetilde{nhf}_{i,t-1} + \varepsilon_{i,t}. \tag{1}$$

The total (time-varying) currency beta is equal to $\beta_{i,t} = \beta_i^c + \beta_i^p \cdot \widetilde{nhf}_{i,t}$. The first component is estimated as a time-invariant characteristic of each currency, but the coefficient β_i^p on the interaction term reflects time-variation in the beta that is related to the positioning of hedge funds in the currency. Selling pressure from unwinding requires a previously held long position, so the sign of $\widetilde{nhf}$ accounts for the direction of the potential endogenous risk. As a result, the hypothesized coefficient, β^p is positive even if the currency's fundamental beta is not. For instance, $\beta_{€}^c$ may be positive, but nonetheless, the euro may correlate negatively with equity markets in times when $\widetilde{nhf}_{€}$ is particularly negative—as during the "divergence trade" in 2014-2015—due to $\beta_{€}^p > 0$. It is not clear a priori whether the magnitude of β_i^p would differ by currency—say, depending on characteristics such as liquidity or other notions of market depth—so I will also estimate a *joint* coefficient β^p from a pooled regression.

Results are reported in Table 3: Over the full sample, β^p is positive for five out of eight currencies and significantly so for four (CAD, CHF, JPY, NZD). While the pooled coefficient is positive, the null of $\beta_0^p = 0$ is not rejected at conventional levels with a p-value of 0.12. However, the effect predominantly occurs in the years *following* the financial crisis (2010-2017). In this post-crisis sample, $\hat{\beta}_i^p$ is positive for all currencies except GBP, and statistically significant for five out of eight (AUD, CAD, CHF, JPY, and NZD). The joint estimate is positive, $\hat{\beta}^p = 0.20$, and statistically significant. In each sample period, the constant baseline betas take signs consistent with conventional wisdom and previous literature on currency risk: all currencies are 'risky' relative to the US dollar in terms of their positive covariance with equity markets, with the exception of the Japanese yen, which is commonly seen as a 'safe haven' and has a significantly negative beta, and the Swiss franc, which is on-par with the US dollar in terms of its equity market risk exposure (zero-beta).

Figure 4 plots baseline beta and the combined beta over the post-crisis sample for the five currencies where $\hat{\beta}^p$ is significantly positive. The positioning-related exposures $\hat{\beta}_i^p \cdot \widetilde{nhf}_{i,t}$ are responsible for total beta-variation (peak-to-trough) of at least 0.31 (CHF), but up to to 0.47 (JPY), compared to an absolute constant beta of 0.26 for the average currency in the post-crisis sample. In February 2016, for instance, hedge funds are heavily long yen futures, and short the Swiss franc (each against the dollar). As a result, the total estimated currency betas at that point in time are indistinguishable at around zero, compared to 0.1 (CHF) and -0.4 (JPY) a year before.

2.1 Futures positions and equity market shocks

To inspect the mechanism that links hedge fund positions and currency betas, I now test whether the size of hedge fund positions varies systematically with equity market returns. To capture the asymmetric effects of positive and negative shocks, I define two truncated weekly S&P-return variables, $r_t^{S\&P^+} = \max(0, r_t^{S\&P})$ and $r_t^{S\&P^-} = \min(0, r_t^{S\&P})$. I compare the levered hedge fund positions and those of their typical counterparties (intermediaries) to positions of other institutional investors. Weekly changes in the absolute net exposures of the different trader groups measure the unwinding of futures positions regardless of whether they were long or short, so the dependent variables are $y_{i,t} = \{\Delta|ndi|, \Delta|nhf|, \Delta|nii|\}$.

$$y_{i,t} = \alpha_i + \eta r_t^{S\&P^-} + \gamma r_t^{S\&P^+} + \delta\, r_{i,t-1} + \varepsilon_{i,t} \tag{2}$$

Table 4 reports the respective results for the pre-crisis, crisis, and post-crisis periods. In the crisis period, hedge fund and intermediary positions are not systematically exposed to equity market shocks, nor are positions of non-commercial traders before the crisis.

For the post-crisis period, however, the positions of intermediaries and hedge funds *contract* with negative equity market returns. The magnitudes of the effects are several times larger than during the earlier sample period, and point to an asymmetry: the effect of negative equity returns is larger than that of positive returns. The discrepancies between the two periods line up with the above results for currency betas: positions scale up and down systematically with equity returns in the post-crisis period, when hedge fund positions help explain the time-variation in currency betas (Table 3). The link between position-size and equity markets is not present for institutional investors in either sample period.

2.2 Realized betas are predictable

The hypothesized mechanism of price pressure from unwinding of intermediated positions during market downturns implies that positioning should predict conditional betas: currencies in which speculators are long experience selling pressure in a downturn, raising their beta, and vice versa for currencies in which speculators are short.

I define the following variables measuring the comovement of currency i with equity markets over the week following the observed positioning at date t: $\rho_{i,t\to t+1}$, the correlation of daily exchange rate movements with daily S&P 500 returns, and $\beta_{i,t\to t+1}$, the beta of daily exchange rate movements with respect to the S&P 500 between t and $t+1$. Table 5 reports the averages, standard deviations, and autocorrelations of these variables by currency. At the weekly horizon, the average autocorrelations are low at 0.24 and 0.11, respectively.[9] To test the predictive power of futures positions for these measures of a currency's equity market risk exposure, I run the forecasting regressions, controlling for changes in interest rates (forward discounts).

$$\Delta y_{i,t\to t+1} = \alpha + \eta\, \Delta \widetilde{nhf}_{i,t} + \phi\, \Delta fd_{i,t} + \varepsilon_{i,t+1}, \tag{3}$$

where $y_{i,t\to t+1} = \{\rho_{i,t\to t+1}, \beta_{i,t\to t+1}\}$. Results are reported in Table 6 for the two subsample periods. Post-crisis hedge fund positioning is a significant and positive predictor of weekly equity market risk as captured by both measures: currencies that are heavily bought by hedge funds in the futures market, have higher correlations and betas with the S&P 500 over the subsequent week. None of these relationships is present in the earlier sample periods, when—recalling Table 4—hedge fund (or non-commercial trader) and intermediary positions are largely uncorrelated with equity market shocks. The result holds within-currency (Panel A) and in the panel (Panel B).

On average, a standard devation change in $\widetilde{nhf}$ is associated with an increase in the currency's exposure to the S&P by 0.09 (correlation) or 0.12 (beta). To put this number into perspective, the largest absolute unconditional betas are around 0.3 to 0.4 (JPY, AUD, MXN, and NZD). As a "placebo" test, I predict equity market exposures using the positions of institutional investors. Unlike hedge funds, institutional investors do not unwind positions with risk-off shocks. As shown in Table 7, their positions do not predict currency betas.

[9] Computing the beta variables over a time horizon as short as one week with daily data inevitably renders these measures noisy. I choose the weekly horizon in order to avoid overlapping observations and make better use of the weekly futures data rather than forecast, say, monthly covariation.

2.3 A contrarian trading strategy

As an additional test of the mechanism and its economic significance, I now construct a trading strategy. The strategy is rebalanced weekly and designed to capitalize on potential temporary price dislocations from the unwinding of hedge fund positions and their intermediary counterparties. The strategy is active following weeks of poor S&P returns, and takes positions in the opposite direction of changes in hedge fund positioning over that week. Specifically, the strategy takes positions at time t if $r_t^{S\&P} < x$, that is, if the S&P return over the week between $t-1$ and t is below a threshold x. It then takes a position in currency i against the dollar if two conditions are jointly satisfied: (i) hedge funds have reduced their positions in currency i, that is, $\Delta|nhf_{i,t}|< 0$, and (ii) currency i has moved in the direction of the change in the net hedge fund position, that is, $\text{sign}(r_{i,t}) = \text{sign}(\Delta nhf_{i,t})$. The first condition identifies unwinding, while the second seeks to isolate flow-induced currency movements.

I formulate two versions of this strategy. In the *contract-weighted* version of this strategy, the positions taken in different currencies in any given week are scaled to be proportional in size to the change in hedge fund positions: let $\Omega_{i,t}^{CW}$ denote the strategy's number of futures contracts in currency i against the dollar at time t:

$$\Omega_{i,t}^{CW} = \frac{\omega_{i,t}^{CW}}{\sum_j |\omega_{j,t}^{CW}| e_{j,t} n_j}, \text{ and } \omega_{i,t}^{CW} = -\Delta nhf_{i,t}\ \mathbb{1}_{\{r_t^{S\&P}<x\}}\ \mathbb{1}_{\{\Delta|nhf|_{i,t}<0\}}\ \mathbb{1}_{\{s(\Delta nhf_{i,t})=s(r_{i,t})\}}$$

where $\mathbb{1}_{\{.\}}$ is the indicator function and $s(\cdot)$ is the sign function. Given the exchange rate $e_{i,t}$ and contract size n_i in units of foreign currency, $e_{i,t}n_i$ expresses the dollar notional of each contract and the denominator therefore scales the positions to ensure that the gross notional of the total position is constant through time at \$1.

The *equal-weighted* version of the strategy fixes the dollar notional of each individual position, such that all non-zero positions taken at any point in time have the same absolute dollar exposure. Denote by $\Omega_{i,t}^{EW}$ the dollar notional amount in futures contracts of currency i against the dollar, then

$$\Omega_{i,t}^{EW} = \frac{\omega_{i,t}^{EW}}{\sum_j |\omega_{j,t}^{EW}|}, \text{ and } \omega_{i,t}^{EW} = -s(\Delta nhf_{i,t}) \; \mathbb{1}_{\{r_t^{S\&P} < x\}} \; \mathbb{1}_{\{\Delta |nhf|_{i,t} < 0\}} \; \mathbb{1}_{\{s(\Delta nhf_{i,t}) = s(r_{i,t})\}}.$$

Both versions of the strategy have a total exposure of one dollar whenever they are active, so the total timing component of the strategy is binary in either case. However, the contract-weighted version 'times' the strategy cross-sectionally by taking larger positions in currencies that have seen larger unwinding of hedge fund positions.

Table 8 reports the key return characteristics of this strategy for the threshold levels $x = 0$, $x = -3\%$, and no threshold at all. Since the strategy relies on a negative realized S&P return, it is only active in a subset of the weeks in the sample from January 2010 until June 2017. For the zero-threshold, this subset includes 138 out of 389 weeks in the sample. The strategy enters positions based on 1-week forward exchange rates (obtained from Bloomberg), and accounts for transaction costs by implementing long (short) positions at the ask (bid) price. Measuring performance over the active weeks, both versions of the strategy are economically profitable, with unlevered weekly mean returns of 7bps and annualized Sharpe ratio of 0.44 for both versions.

Under a stricter conditioning rule, where the strategy only becomes active if the previous week's S&P return was below -3%, the strategy only trades in 18 weeks. Average returns rise to, respectively, 39bps (contract-weighted) and 30bps per week, and the annualized Sharpe ratios rise to 2.10 and 1.90, respectively.[10] For comparison, the unconditional strategy—which takes FX positions in the opposite direction of previous hedge fund flows irrespective of whether or not these flows coincided with negative

[10]Accounting for all inactive periods in the annualization, Sharpe ratios range from 0.45 to 0.41. This magnitude is comparable to that of a portfolio composed of the observable hedge fund positions across the eight sample currencies.

equity market returns yields weekly returns close to zero. This comparison suggests, that hedge fund flows are only associated with temporary price dislocations that revert quickly (within the next week), if these flows occur during times, when the market environment deteriorates. Over active weeks, the strategy has a positive S&P-beta of around 0.3, varying slightly by threshold and weighting; the strategy is particularly profitable when market recovery prevents additional unwinding and further price impact. The same strategy using the positions of non-commercial traders between 2000 and 2006 does not generate positive average returns.

2.4 Currency comovement

Next, I examine comovement between exchange rates with similar hedge fund positioning. In the spirit of Antón and Polk (2014) and Lou and Polk (2019), I test whether currencies, in which hedge funds are positioned in the same direction (long or short), are more positively correlated. Let $\rho_{i,j,t}$ be the correlation in the exchange rate movements of currencies i and j over the week following date t.

To capture similarities in hedge fund positioning across currencies, as well as the magnitude of positions, I define a *positioning score*, $PS_{i,j,t}(\widetilde{nhf}) \equiv |\widetilde{nhf}_{i,t} + \widetilde{nhf}_{j,t}| - |\widetilde{nhf}_{i,t} - \widetilde{nhf}_{j,t}|$. While the second term captures similarities in positioning in a straightforward way, two currencies with no hedge fund positions have *similar* positioning, but no reason to comove endogenously under the proposed mechanism. The first term therefore accounts for the absolute level of positioning, such that a higher positioning score reflects both larger and more similar positions by hedge funds (and analogously for institutional investors and non-commercial traders).

I regress pairwise intra-week correlation on the positioning scores, controlling for the size of the pairwise interest differential, $|fd_{i,t} - fd_{j,t}|$. I further include currency-pair fixed effects in order to absorb any other (time-invariant) sources of correlation.

Since all currencies are measured against the dollar, changes in the value of the dollar will affect pairwise correlations. Dollar volatility may bias the results if positioning is systematically associated with expected dollar volatility. I therefore also include time fixed effects, thus taking out the common dollar factor. Table 9 shows that two currencies are more correlated if they have larger and more similar hedge fund positioning, that is, a higher $PS(\widetilde{nhf})$. The result is not statistically significant for the 2006-2009 period, but this may be due to lack of power over the shorter sample.

Brunnermeier et al. (2008) conduct a similar exercise for intra-quarter correlations, but use interest differentials to proxy for hedge fund positions, finding that currencies with similar interest rates move together. Instead, I use the positioning data directly and find that currencies with similar positioning move together (controlling for interest rate similarities). However, unlike the previous results in this paper, this link is not new to the post-GFC world. The same result holds prior to 2006 for non-commercial traders, albeit with a much smaller point estimate. I do not find any such link for the positioning of institutional investors, so it is possible that the smaller magnitude reflects attenuation due to the broader definition of the non-commercial traders category.

Contrasting the correlation result with the previous results on betas shows how the results in this paper fit into the literature. The notion that positioning of certain traders shapes risk profiles is a central message of earlier papers, including Brunnermeier et al. (2008) and Cho (forthcoming). This paper is the first to show that, since the financial crisis, positioning has become sensitive to equity market risk, and the endogenous risk exposures therefore manifest in the form of market betas. Compared to more exotic risk loadings on broker-dealer leverage or return skewness, equity market risk is harder to diversify. The systematic nature of the endogenous loading raises the economic relevance of the risk externality imposed by hedge funds on all market participants.

2.5 Inspecting the mechanism

But what has changed since the financial crisis to line up positioning risk with equity market risk? The asset pricing literature has identified a number of new phenomena since the financial crisis, such as large deviations from covered interest parity (see e.g., Du et al., 2018). Table 4 shows that hedge fund and intermediary positions do not unwind with negative S&P returns during 2006-2009, nor do those of non-commercial traders prior to 2006. It is conceivable that the market environment for leveraged positions has become more fickle in the post-crisis world. Particularly, it may have become more sensitive to equity market returns, in contrast to the previously established relationship between unwinding and the VIX or TED spread (Brunnermeier et al., 2008) which pre-dates the financial crisis.

Changes in unwinding behavior may be driven by hedge funds or the intermediaries serving as their counterparties, that is, the demand or the supply of levered speculative positions. The results are consistent with (i) hedge funds becoming less 'market-neutral' since the crisis, and/or (ii) leverage provision by intermediaries becoming more sensitive to equity market movements. Replacing the S&P 500 with the respective sector index for financial companies (as a proxy for intermediary wealth) or with the VIX (for margin tightness, following Brunnermeier et al., 2008) produces similar but less pervasive results, than the S&P 500 itself. These weaker results relative to the wider equity market are less supportive of the supply-side explanation.

3 Alternative explanations

Is this strong relationship between hedge fund positioning and market risk exposures really driven by the price impact of unwinding positions when equity markets are down? For instance, one might expect hedge fund positions to reflect unobservable signals about conditional risk loadings and premia. If these are related to market risk, positions would predict betas, not because one is driving the other but because both are driven by changes in fundamental risk profiles. Given the size of the futures market relative to total FX trading, another important question is whether futures positions are a relevant measure of the overall positioning of different groups of market participants. This section addresses these questions in turn, starting with the latter.

3.1 Flows and returns

For hedge fund positions to be the driver of time-varying currency betas, the unwinding of these positions must have price impact. An important concern when looking at futures data is that the futures market accounts for only a small fraction of currency trading; most trades are done over-the-counter in the forward market and will therefore not be reported to the CFTC. The futures data are the best publicly available indication of the overall positioning of market participants, and it is unclear why and how positioning in the forward market would differ systematically from that in the futures market. Accordingly, there is no obvious direction to any potential bias in the empirical results. As empirical support for the relevance of the futures data, I can test whether exchange rates move with hedge fund positions in the futures market.

Price impact implies a systematic contemporaneous association between changes in the positions of traders (i.e., portfolio flows of hedge funds) and exchange rate movements. I regress net currency movements, $r_{i,t} = e_{i,t}/e_{i,t-1} - 1$, on the changes in nhf and $\widetilde{nhf}$. This set of regressions merely serves as a simple sense-check of whether or not the futures data are consistent with this prediction. A lack of contemporaneous association between flows and returns would cast doubt on the interpretation of the link between currency betas and futures positions. For each currency, I run

$$r_{i,t} = \alpha_i + \eta_i \Delta nhf_{i,t} + \gamma_i \Delta nii_{i,t} + \varepsilon_{i,t} \tag{4}$$

$$r_{i,t} = \alpha_i + \eta_i \Delta \widetilde{nhf}_{i,t} + \gamma_i \Delta \widetilde{nii}_{i,t} + \varepsilon_{i,t}, \tag{5}$$

The results are reported in Table 10: for both regressions the estimates for η_i are positive and highly significant for all currencies. In comparison, the statistical significance of this result is less pervasive for institutional investors, where most estimates, $\hat{\gamma}_i$, are positive, but only significant ($p < 0.05$) for 4 out of 8 currencies. The observable futures data are therefore consistent with price impact from hedge fund portfolio flows. Yet, the results from these contemporaneous regressions are equally consistent with the reverse interpretation that investor positions "chase" returns rather than "driving" them, as long as the within-week returns precede the unobservable within-week flows. It is further consistent with flows driving exchange rates by revealing private information of hedge funds (Evans and Lyons, 2002).

3.2 Anticipation of risk premia

The second empirical concern in this setting is the endogeneity of positions. Do positions predict betas because unwinding has price impact, or do the anticipated betas lead hedge funds to position themselves in the way they do? The question boils down to whether weekly variations in *fundamental* currency correlations with equity markets are predictable by hedge funds when they choose their positions. I provide two results, each partially addressing this concern.

Risk exposures do not predict hedge fund positions.—I reverse the forecasting regressions from Subsection 2.2, using changes in equity market exposures to predict changes in hedge fund positioning. Table 11 shows that the forecasting relationship does not hold in reverse: much to the contrary, the S&P-correlations *negatively* predicts futures positions—the exact opposite of the forecasting relationship from positions to correlations. There is no significant predictability of hedge fund positions from realized betas. Given that the comovement variables are positively autocorrelated, albeit weakly, this is inconsistent with the alternative explanation that speculators extrapolate risk exposures and enter positions to collect risk premia.

Beta predictability is not driven by scheduled FOMC announcements.—There are, however, instances in which risk premia (and potentially also currency betas) may reasonably be predictable, even at a weekly horizon, without extrapolating from the recent past. One such predictable premium may stem from the exposure to scheduled FOMC announcements. Savor and Wilson (2014) and Mueller et al. (2017) find that these announcements are accompanied by substantial excess returns of foreign currencies against the US dollar, and interpret these returns as compensation for monetary policy uncertainty. To test whether the results reported so far are driven by a strong relationship between hedge fund positioning and realized currency betas around a scheduled FOMC announcement, I consider those weeks separately from non-announcement weeks. Table 12 shows the results for Regression (3) splitting the sample into FOMC announcement weeks and non-announcement weeks. The results only show up significantly during non-announcement weeks, showing that scheduled announcement risk is not responsible for the headline results of this paper. The non-result is not purely driven by lack of power from the smallet sample, since the non-announcement weeks also feature substantially larger point estimates.

4 Conclusion

This paper documents a close link between the positioning of leveraged speculators and currency betas since the financial crisis. A currency is more exposed to movements in equity markets when hedge funds hold long positions in that currency. Hedge fund positions in the futures market predict realized exposures at weekly frequencies. At the same time, the size of positions held by hedge funds and intermediaries, decreases following a negative shock to the S&P. The positions of institutional investors and those of 'non-commercial traders' before 2006 (including hedge funds) do not show this sensitivity, nor do they forecast currency-equity comovement.

In futures markets, speculators predominantly trade with intermediaries. My results are consistent with intermediary counterparties transmitting hedge fund positioning to the spot market by hedging their futures exposures. When speculators and intermediaries unwind their futures positions following adverse equity market shocks, currency spot markets fail to absorb the resulting flows, such that unwinding has price impact. As a result, currencies involved in speculative trading become endogenously exposed to equity market risk with the sign depending on the direction in which they are held by speculators. Hedge funds not only price market risk but actively shape the short-horizon market risk exposures of the assets they trade

I design a trading strategy to exploit the temporary price dislocations in currency markets associated with unwinding hedge fund positions in adverse equity market environments. The strategy provides liquidity by trading in the opposite direction of the unwinding. It is highly economically attractive with a Sharpe Ratio of up to 2. I do not find evidence of reverse causality: speculative positions are not forecastable by a currency's realized beta, and the predictability result for conditional betas does not arise during weeks with scheduled FOMC announcements.

The recent emergence of the link between currency-equity comovement and hedge fund positions is in line with a broad literature in asset pricing on post-crisis phenomena in financial markets (e.g., Du et al., 2018; Lilley and Rinaldi, 2019). The findings imply that the risk profiles of speculative strategies suffer more from their own popularity since the financial crisis. Furthermore, the post-crisis endogenous variation is more closely aligned with broader market risk, and therefore less diversifiable, both for the specualtor and other traders participating in currency markets.

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A Tables and Figures

Table 1: Correlations of futures positions

This table reports the correlations of net positions of different trader groups, measured in contracts (Panels A and C), and percentage of open interest (B and D).

Panel A: Contracts (levels)					*Panel B: Shares of open interest (levels)*				
	ndi	nhf	nii	no		$\widetilde{ndi}$	$\widetilde{nhf}$	$\widetilde{nii}$	$\widetilde{no}$
ndi	1				$\widetilde{ndi}$	1			
nhf	-0.882	1			$\widetilde{nhf}$	-0.880	1		
nii	-0.427	0.041	1		$\widetilde{nii}$	-0.372	0.044	1	
no	0.149	-0.332	-0.115	1	$\widetilde{no}$	-0.007	-0.204	-0.047	1
Panel C: Contracts (changes)					*Panel D: Shares of open interest (changes)*				
ndi	1				$\widetilde{ndi}$	1			
nhf	-0.871	1			$\widetilde{nhf}$	-0.848	1		
nii	-0.214	-0.109	1		$\widetilde{nii}$	-0.177	-0.161	1	
no	-0.137	-0.127	-0.065	1	$\widetilde{no}$	-0.051	-0.171	-0.072	1

Table 2: Summary statistics of futures positions

This table reports the means and standard deviations of net positions, in thousands of contracts (unscaled, top panel) and shares of open interest (bottom panel), of intermediaries ($ndi, \widetilde{ndi}$), hedge funds ($nhf, \widetilde{nhf}$), institutional investors ($nii, \widetilde{nii}$), and others ($no, \widetilde{no}$). The bottom three rows of each panel report, respectively, the average time-series standard deviation (averaged across currencies), the cross-sectional standard deviation of the within-currency means, and the total panel standard deviation.

	$\mu(ndi)$	$\mu(nhf)$	$\mu(nii)$	$\mu(no)$	$\sigma(ndi)$	$\sigma(nhf)$	$\sigma(nii)$	$\sigma(no)$
AUD	-16.32	24.17	-7.29	-4.27	62.29	36.81	19.31	9.30
CAD	-11.94	-2.95	2.58	6.17	48.37	35.72	12.97	6.80
CHF	5.74	-4.08	-0.63	0.47	22.91	15.50	1.10	2.86
EUR	27.16	-27.61	-2.25	9.48	82.10	62.41	25.45	17.69
GBP	25.93	8.42	-24.52	-7.08	72.64	48.09	25.48	10.50
JPY	19.44	-20.98	10.29	3.14	63.90	52.32	23.39	18.13
MXN	-32.75	14.71	18.78	-2.39	44.68	47.76	17.06	5.39
NZD	-5.93	7.93	-2.32	-0.30	11.75	9.37	5.90	1.35
Time-series	1.41	-0.05	-0.67	0.65	51.08	38.50	16.33	9.00
Cross-section					21.78	17.57	12.69	5.46
Pooled					64.29	47.75	22.58	13.02
	$\mu(\widetilde{ndi})$	$\mu(\widetilde{nhf})$	$\mu(\widetilde{nii})$	$\mu(\widetilde{no})$	$\sigma(\widetilde{ndi})$	$\sigma(\widetilde{nhf})$	$\sigma(\widetilde{nii})$	$\sigma(\widetilde{no})$
AUD	-0.18	0.21	-0.05	-0.03	0.49	0.29	0.14	0.08
CAD	-0.12	-0.02	0.03	0.05	0.36	0.26	0.11	0.06
CHF	0.08	-0.05	-0.01	0.01	0.38	0.24	0.02	0.07
EUR	0.04	-0.06	-0.01	0.03	0.30	0.21	0.08	0.05
GBP	0.14	0.07	-0.14	-0.05	0.40	0.27	0.13	0.07
JPY	0.04	-0.06	0.08	0.01	0.35	0.26	0.15	0.10
MXN	-0.26	0.12	0.14	-0.02	0.34	0.37	0.11	0.05
NZD	-0.22	0.26	-0.06	-0.01	0.41	0.30	0.15	0.05
Time-series	-0.06	0.06	0.00	0.00	0.38	0.28	0.11	0.07
Cross-section					0.15	0.13	0.09	0.03
Pooled					0.40	0.13	0.28	0.08

Table 3: The interaction of futures bets and currency betas

This table reports the estimates ant t-statistics for time-series regressions of daily currency returns on S&P 500 returns and its interaction with the relative positioning of hedge funds $(\widetilde{nhf})$.

$$r_{i,t} = \alpha_i + \beta_i^c r_t^{S\&P} + \beta_i^p \widetilde{nhf}_{i,t-1} \cdot r_t^{S\&P} + \gamma_i \widetilde{nhf}_{i,t-1} + \varepsilon_{i,t}, \quad (1)$$

where $r_{i,t}$ and $r_t^{S\&P}$ denote the currency return of currency i and the return on the S&P 500 from day $t-1$ to day t, respectively. The last column shows the estimate of β^p obtained from the pooled regression. The standard errors for the pooled regression are clustered at the currency level.

	AUD	**CAD**	**CHF**	**EUR**	**GBP**	**JPY**	**MXN**	**NZD**	**pooled**
					Panel A: Full sample 2006 - 2017				
β_i^c	0.42	0.30	0.02	0.13	0.14	-0.24	0.39	0.37	
	(15.03)	(25.43)	(0.93)	(10.19)	(10.59)	(-16.82)	(20.39)	(23.54)	
β_i^p	0.03	0.26	0.21	-0.08	-0.07	0.30	-0.07	0.13	0.08
	(0.33)	(6.13)	(2.70)	(-1.06)	(-1.63)	(5.21)	(-1.75)	(3.24)	(1.69)
R^2 in %	35.76	33.49	0.62	7.36	8.84	18.30	35.51	29.12	22.58
Obs.	2,871	2,871	2,871	2,871	2,871	2,871	2,871	2,871	22,968
					Panel B: Pre-Crisis / Crisis 2006 - 2009				
β_i^c	0.43	0.27	0.00	0.11	0.12	-0.25	0.34	0.38	
	(11.51)	(15.44)	(0.02)	(6.21)	(7.09)	(-11.98)	(11.34)	(19.21)	
β_i^p	-0.14	0.18	0.14	-0.06	-0.05	0.12	-0.11	0.11	0.01
	(-1.17)	(2.72)	(1.82)	(-0.44)	(-0.67)	(1.30)	(-2.21)	(1.88)	(0.14)
R^2 in %	39.65	31.24	0.75	7.79	9.65	28.14	41.56	34.88	28.38
Obs.	928	928	928	928	928	928	928	928	7,424
					Panel C: Post-Crisis 2010 - 2017				
β_i^c	0.38	0.35	0.03	0.19	0.17	-0.20	0.47	0.32	
	(17.79)	(28.12)	(0.90)	(8.30)	(8.35)	(-10.47)	(25.32)	(10.16)	
β_i^p	0.27	0.32	0.27	0.12	-0.12	0.46	0.01	0.25	0.20
	(4.58)	(6.55)	(1.84)	(1.12)	(-2.24)	(6.30)	(0.23)	(3.55)	(2.77)
R^2 in %	32.39	37.05	0.65	7.70	8.73	12.47	33.87	23.87	18.95
Obs.	1,942	1,942	1,942	1,942	1,942	1,942	1,942	1,942	15,536

Table 4: Futures positions and equity market risk

This table reports the results for pooled panel regressions of changes in the absolute size of futures positions by each trader group on contemporaneous S&P 500 returns. Negative (positive) changes in the size of futures positions ($\Delta|ndi|$, $\Delta|nhf|$, $\Delta|nii|$, and $\Delta|nnc|$) reflect contractions (expansions) of the outstanding bets of each trader group. To measure asymmetric shocks to the market risk-taking environment, I define $r_t^{S\&P^+} = [r_t^{S\&P}]^+$, $r_t^{S\&P^-} = [r_t^{S\&P}]^-$. I then run the following contemporaneous regressions.

$$y_{i,t} = \alpha_i + \eta r_t^{S\&P^-} + \gamma r_t^{S\&P^+} + \delta\, r_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

for $y_{i,t} = \{\Delta|ndi|, \Delta|nhf|, \Delta|nii|, \Delta|nnc|\}$, and where $r_{i,t}$ denotes the currency return of currency i from week $t-1$ to week t. Standard errors are clustered at the currency level and t-statistics reported in parentheses.

	Panel A: Pre-Crisis / Crisis				*Panel B: Post-Crisis*		
	Intermed.	Hedge Funds	Inst. Inv.	Non-Com. Traders	Intermed.	Hedge Funds	Inst. Inv.
	2006-2009	2006-2009	2006-2009	2000-2006	2010-2017	2010-2017	2010-2017
$r_t^{S\&P^-}$	-13.67	-8.25	2.67	11.84	73.77	35.30	-17.84
	(-0.81)	(-0.60)	(1.01)	(1.15)	(2.23)	(1.99)	(-1.34)
$r_t^{S\&P^+}$	1.63	11.07	-12.15	-15.37	40.75	15.84	2.07
	(0.12)	(0.83)	(-1.45)	(-1.21)	(2.23)	(0.85)	(0.16)
$r_{i,t-1}$	111.60	73.07	-8.00	56.96	-53.20	-8.25	-9.74
	(2.53)	(1.69)	(-3.38)	(0.87)	(-1.10)	(-0.23)	(-0.75)
Intercept	-0.19	-0.21	0.17	0.38	0.11	0.07	-0.07
	(-0.66)	(-1.03)	(1.62)	(1.87)	(0.37)	(-0.37)	(-0.51)
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 in (%)	2.27	1.42	0.94	0.91	1.00	0.28	0.40
Obs.	1,476	1,476	1,476	2,345	3,104	3,104	3,104

Table 5: Summary statistics of short-run currency comovement with equity markets

This table reports the mean, standard deviation, and autocorrelation of currency betas, $\beta_{i,t\to t+1}$, and correlations with the S&P, $\rho_{i,t\to t+1}$. The correlations and betas are computed using closing prices for the 5 trading days following date t to result in weekly observations over the full sample from January 2006 to June 2017.

	$\rho_{i,t\to t+1}$			$\beta_{i,t\to t+1}$		
	Mean	Standard dev.	Autocorrelation	Mean	Standard dev.	Autocorrelation.
AUD	0.25	0.57	0.32	0.22	0.58	0.17
CAD	0.29	0.53	0.32	0.19	0.47	0.14
CHF	-0.05	0.56	0.23	-0.03	0.67	0.10
EUR	0.06	0.57	0.25	0.05	0.55	0.18
GBP	0.07	0.55	0.16	0.07	0.52	0.08
JPY	-0.21	0.54	0.21	-0.15	0.56	0.11
MXN	0.40	0.50	0.20	0.30	0.51	0.05
NZD	-0.03	0.51	0.34	-0.01	0.49	0.19
Mean	0.10	0.54	0.25	0.08	0.54	0.13

Table 6: Predicting equity risk exposures using hedge fund positioning

This table reports the estimates and t-statistics for pooled panel regressions of the realized correlations and betas of exchange rates with the S&P on the scaled level of net positions of hedge funds, denoted by $\widetilde{nhf}$. The realized betas and correlations are computed using closing prices for the 5 trading days following date t. The data form an unbalanced panel for three subsample periods 2000-2006 (non-commercial traders, $\widetilde{nnc}$), 2006-2009 and 2010-2017 (hedge funds). I run the following predictive regressions for $y_{i,t\to t+1} = \{\rho_{i,t\to t+1}, \beta_{i,t\to t+1}\}$:

$$\Delta y_{i,t\to t+1} = \alpha_i + \eta\, \Delta\widetilde{nhf}_{i,t} + \phi\, \Delta fd_{i,t} + \varepsilon_{i,t+1}, \tag{3}$$

where $fd_{i,t}$ denotes the 1-week forward discount of currency i versus the dollar. Standard errors are clustered at the currency level and t-stats reported in parentheses.

	Panel A: with currency fixed effects					
	2000 - 2006		2006-2009		2010-2017	
	$\Delta\rho$	$\Delta\beta$	$\Delta\rho$	$\Delta\beta$	$\Delta\rho$	$\Delta\beta$
$\Delta\widetilde{nhf}_t$			0.03	0.00	0.33	0.44
			(0.17)	(0.01)	(2.30)	(3.02)
$\Delta\widetilde{nnc}_t$	0.05	0.15				
	(0.59)	(1.46)				
Δfd_t	-15.24	-137.96	-59.45	-104.57	-273.61	-268.11
	(-0.15)	(-1.85)	(-0.68)	(-1.80)	(-1.86)	(-0.60)
R^2 in (%)	0.01	0.05	0.01	0.04	0.25	0.22
	Panel B: without currency fixed effects					
$\Delta\widetilde{nhf}_t$			0.03	0.00	0.33	0.44
			(0.17)	(0.02)	(2.30)	(3.02)
$\Delta\widetilde{nnc}_t$	0.05	0.15				
	(0.36)	(0.92)				
Δfd_t	-15.34	-137.78	-59.48	-104.56	-273.60	-268.04
	(-0.06)	(-0.73)	(-0.46)	(-1.16)	(-1.86)	(-0.60)
Obs.	2,345	2,345	1,476	1,476	3,104	3,104

Table 7: Predicting equity risk exposures using institutional investor positioning

This table reports the results for pooled panel regressions of the realized correlations and betas of exchange rates with the S&P on the scaled level of net positions of institutional investors, denoted by $\widetilde{nii}$. The realized betas and correlations are computed using closing prices for the 5 trading days following date t. The data form an unbalanced panel for the period 2010-2017. I run the following predictive regressions for $y_{i,t\to t+1} = \{\rho_{i,t\to t+1}, \beta_{i,t\to t+1}\}$:

$$\Delta y_{i,t\to t+1} = \alpha_i + \eta\, \Delta\widetilde{nii}_{i,t} + \phi\, \Delta fd_{i,t} + \varepsilon_{i,t+1}, \tag{3}$$

where $fd_{i,t}$ denotes the 1-week forward discount of currency i versus the dollar. Standard errors are clustered at the currency level and t-statistics reported in parentheses.

	Panel A: with currency fixed effects		*Panel B: without currency FE*	
	$\Delta\rho$	$\Delta\beta$	$\Delta\rho$	$\Delta\beta$
$\Delta\widetilde{nii}_t$	0.01	0.11	0.01	0.11
	(0.05)	(0.30)	(0.05)	(0.30)
Δfd_t	-280.48	-276.95	-280.47	-276.86
	(-1.94)	(-0.63)	(-1.94)	(-0.63)
R^2 in (%)	0.10	0.06	0.10	0.06
Currencies	8	8	8	8
Observations	3,104	3,104	3,104	3,104

Table 8: A contrarian trading strategy

This table reports the returns to the trading strategy described in subsection 2.3 for different conditioning thresholds of the S&P return. The strategy is designed to exploit temporary dislocations in FX markets following the unwinding of futures positions by hedge funds. Let $\Omega_{i,t}^{CW}$ denote the *number of futures contracts* in currency i against the dollar, included in the strategy at time t:

$$\Omega_{i,t}^{CW} = \frac{\omega_{i,t}^{CW}}{\sum_j |\omega_{j,t}^{CW}| e_{i,t} s_i}, \text{ where } \omega_{i,t}^{CW} = -\Delta nhf_{i,t}\ \mathbb{1}_{\{r_t^{S\&P}<x\}}\ \mathbb{1}_{\{\Delta|nhf|_{i,t}<0\}}\ \mathbb{1}_{\{\text{sign}(\Delta nhf_{i,t})=\text{sign}(r_{i,t})\}}$$

where $\mathbb{1}_{\{\cdot\}}$ is the indicator function which takes value 1 if $\cdot$ is true, and 0 otherwise, $e_{i,t}$ denotes the exchange rate, and n_i the contract size in units of foreign currency, such that $e_{i,t}n_i$ expresses the dollar notional of each contract. Denote by $\Omega_{i,t}^{EW}$ the *dollar notional amount* in futures contracts of currency i against the dollar at time t

$$\Omega_{i,t}^{EW} = \frac{\omega_{i,t}^{EW}}{\sum_j |\omega_{j,t}^{EW}|}, \text{ where } \omega_{i,t}^{EW} = -\text{sign}(\Delta nhf_{i,t})\ \mathbb{1}_{\{r_t^{S\&P}<x\}}\ \mathbb{1}_{\{\Delta|nhf|_{i,t}<0\}}\ \mathbb{1}_{\{\text{sign}(\Delta nhf_{i,t})=\text{sign}(r_{i,t})\}}.$$

The *contract-weighted* (CW) strategy is described by $\Omega_{i,t}^{CW}$ and takes positions, which are proportional in the cross section to the amount of positions unwound by hedge funds over the previous week. The *equal-weighted* (EW) strategy is described by $\Omega_{i,t}^{EW}$ and fixes the dollar notional of each individual position, such that all non-zero positions taken at any point in time have the same absolute dollar exposure. Both strategies have a gross dollar notional of \$1 in each week, where the strategy is active. The below returns are based on 1-week forward exchange rates, with long (short) positions transacted at the ask (bid) price. Returns are unlevered and refer to positions formed weekly between January 5, 2010 and June 6, 2017. The strategy is inactive in week t, if $\Omega_{i,t} = 0\,\forall\, i$.

Threshold (x)	$r^{S\&P} < 0$		$r^{S\&P} < -3\%$		None	
	CW	EW	CW	EW	CW	EW
Mean return p.w. (in %)	0.07	0.07	0.39	0.30	0.03	-0.01
Std. deviation p.w. (in %)	1.16	1.09	1.34	1.15	1.15	1.05
Sharpe ratio p.a.	0.44	0.44	2.10	1.90	0.20	-0.05
Total compound return (in %)	9.07	8.61	7.08	5.49	9.71	-4.37
Weeks total	389		389		389	
Weeks active	138		18		362	
Weeks active (in %)	35.48		4.63		93.06	

Table 9: Predictable currency comovement

This table reports the results for pooled panel regressions of the realized currency correlations on a variable capturing similarities in investor positioning. The hedge-fund *positioning score* for currency pair $\{i, j\}$ is defined as $PS_{i,j,t}(\widetilde{nhf}) = |\widetilde{nhf}_{i,t} + \widetilde{nhf}_{j,t}| - |\widetilde{nhf}_{i,t} - \widetilde{nhf}_{j,t}|$, and analogously for institutional investors ($\widetilde{nii}$) and non-commercial traders ($\widetilde{nnc}$, 2000-2006). The dependent variable, $\rho_{i,j,t \to t+1}$ is the realized pairwise correlation for 28 dollar-neutral currency pairs $\{i, j\}$ (constructed from 8 foreign currencies) over the 5 trading days following date t. Each panel regression controls for the absolute pairwise interest differential, measured using $fd_{i,t}$, the 1-week forward discount of each currency against the dollar. Standard errors underlying the t-statistics in parentheses are robust to heteroskedasticity.

Sample	2000-2006	2006-2009	2010-2017
$PS_{i,j,t}(\widetilde{nhf})$		0.21	0.30
		(1.31)	(2.53)
$PS_{i,j,t}(\widetilde{nii})$		0.09	0.04
		(1.52)	(1.69)
$PS_{i,j,t}(\widetilde{nnc})$	0.05		
	(3.45)		
$\|fd_{i,t} - fd_{j,t}\|$	0.33	1.81	-1.20
	(1.80)	(6.88)	(-4.17)
Currency-pair FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	7,355	5,001	10,476

Table 10: Regression of currency movements on contemporaneous net futures flows

This table reports the results for a contemporaneous regression of exchange rate movements on weekly net flows in futures positions. I regress weekly returns on the contemporaneous change in the net long position of hedge funds (nhf) and institutional investors (nii), first in absolute terms and then scaled by open interest ($\widetilde{nhf}$, $\widetilde{nii}$).

$$r_{i,t} = \alpha_i + \eta_i \Delta nhf_{i,t} + \gamma_i \Delta nii_{i,t} + \varepsilon_{i,t} \tag{4}$$

$$r_{i,t} = \alpha_i + \eta_i \Delta \widetilde{nhf}_{i,t} + \gamma_i \Delta \widetilde{nii}_{i,t} + \varepsilon_{i,t} \tag{5}$$

where $r_{i,t} = e_{i,t}/e_{i,t-1} - 1$ denotes the currency return on currency i versus the US dollar from week $t-1$ to week t. $\Delta nhf_{i,t}$ and $\Delta nii_{i,t}$, respectively, denote the change in the net positions of hedge funds and institutional investors in currency i versus the US dollar from week $t-1$ to week t, while $\Delta\widetilde{nhf}_{i,t}$ and $\Delta\widetilde{nii}_{i,t}$ refer analogously to the positions scaled by open interest. All futures positions are expressed in thousands of contracts. The estimated coefficients for regressions (4) and (5) are reported below with their respective robust t-statistics in parentheses. The weekly exchange rate movements and forward discounts are expressed in %.

	AUD	*CAD*	*CHF*	*EUR*	*GBP*	*JPY*	*MXN*	*NZD*
Panel A: Contracts								
Δnhf_t	0.07	0.05	0.07	0.04	0.04	0.04	0.03	0.26
	(11.96)	(8.10)	(5.63)	(11.22)	(9.35)	(12.38)	(6.53)	(8.61)
Δnii_t	0.01	0.07	0.65	0.05	0.01	0.08	0.00	0.36
	(0.21)	(1.88)	(2.37)	(3.97)	(0.55)	(4.97)	(0.36)	(4.39)
R^2 in %	19.08	11.05	11.42	19.17	13.14	25.36	6.60	15.61
Panel B: Shares of open interest								
	AUD	*CAD*	*CHF*	*EUR*	*GBP*	*JPY*	*MXN*	*NZD*
$\Delta\widetilde{nhf}_t$	9.27	5.17	3.58	8.84	6.01	7.70	4.01	6.03
	(9.76)	(6.61)	(4.39)	(9.34)	(9.99)	(11.61)	(6.17)	(5.64)
$\Delta\widetilde{nii}_t$	-1.03	7.49	28.75	9.71	-2.56	7.38	0.67	10.91
	(-0.29)	(1.94)	(2.21)	(2.81)	(-0.86)	(3.27)	(0.35)	(4.45)
R^2 in %	16.19	8.17	7.33	14.02	12.51	19.53	6.82	11.53
Obs.	573	573	573	573	573	573	573	569

Table 11: Predicting futures positions using equity risk exposures

This table reports the results for pooled panel regressions of net hedge fund futures positions on previous correlations and betas of exchange rates with the S&P. The realized betas and correlations are computed using closing prices for the 5 trading days preceding date t. I run the following forecasting regressions for $y_{i,t\to t+1} = \{\rho_{i,t\to t+1}, \beta_{i,t\to t+1}\}$:

$$\Delta\widetilde{nhf}_{i,t+1} = \alpha_i + \eta\,\Delta y_{i,t-1\to t} + \phi\,\Delta fd_{i,t} + \varepsilon_{i,t+1}, \tag{3}$$

where $\Delta fd_{i,t}$ denotes the change in the 1-week forward discount of currency i versus the dollar from week $t-1$ to week t. Standard errors are clustered at the currency level and t-statistics reported in parentheses.

$\Delta\rho_{i,t-1\to t}$	-0.003		-0.030	
	(-2.25)		(-1.44)	
$\Delta\beta_{i,t-1\to t}$		-0.001		-0.001
		(-0.63)		(-0.33)
$\Delta fd_{i,t}$	7.569	8.213	7.589	8.233
	(0.81)	(0.85)	(0.42)	(0.46)
Currency FE	Yes	Yes	No	No
R^2 in (%)	0.07	0.01	0.07	0.01
Currencies	8	8	8	8
Observations	3,104	3,104	3,104	3,104

Table 12: Predicting risk using net futures positions – FOMC announcement weeks

This table reports the results for pooled panel regressions of the realized correlations and betas of exchange rates with the S&P on the scaled level of net positions of hedge funds (denoted by $\widetilde{nhf}$). The realized betas and correlations are computed using closing prices for the 5 trading days following date t. The data form an unbalanced panel for the post-crisis 2010-2017. 58 of the 388 weeks in that period include a scheduled FOMC announcement, and the "Announcement" subsample contains 502 currency-week observations. I run the following predictive regressions for $y_{i,t\to t+1} = \{\rho_{i,t\to t+1}, \beta_{i,t\to t+1}\}$:

$$\Delta y_{i,t\to t+1} = \alpha_i + \eta\, \Delta\widetilde{nhf}_{i,t} + \phi\, \Delta fd_{i,t} + \varepsilon_{i,t+1}, \tag{3}$$

where $fd_{i,t}$ denotes the 1-week forward discount of currency i versus the dollar and $r_{i,t}$ denotes the currency return of currency i from week $t-1$ to week t. Standard errors are clustered at the currency level and t-statistics reported in parentheses. The panel entitled "Announcement" reports the results over all 58 weeks from 2010-2017 that contained a scheduled FOMC announcement, while the "Non-Announcement" panel reports the results for the remaining 330 weeks.

	Non-Announcement		*Announcement*	
	$\Delta\rho$	$\Delta\beta$	$\Delta\rho$	$\Delta\beta$
$\Delta\widetilde{nhf}_t$	0.39	0.53	0.21	0.27
	(3.17)	(4.14)	(0.49)	(0.70)
Δfd_t	-258.39	-234.06	-544.07	-782.84
	(-2.15)	(-0.51)	(-0.95)	(-1.01)
Currency FE	Yes	Yes	Yes	Yes
R^2 in (%)	0.29	0.25	0.21	0.32
Currencies	8	8	8	8
Obs.	2,640	2,640	464	464

Figure 3: Time-variation in futures positions (in 000's of contracts): hedge funds (nhf, solid, blue), intermediaries (ndi, dotted, black), and institutional investors (nii, dashed, red).

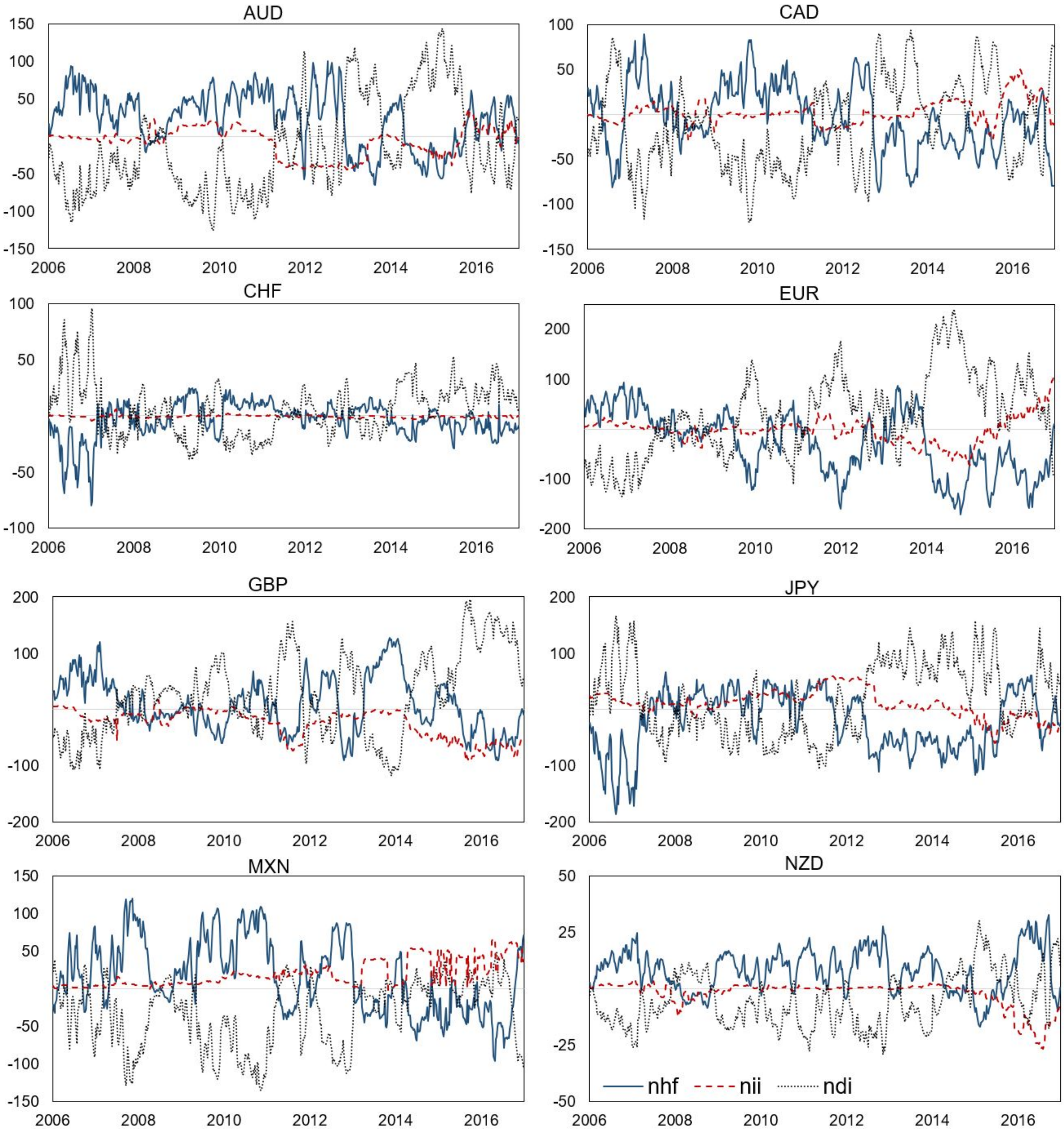

Figure 4: The figure plots the time-invariant baseline betas, $\hat{\beta}_i^c$, from Table 3 and the total exposures, computed as $\hat{\beta}_i^c + \hat{\beta}_i^p \cdot \widetilde{nhf}_{i,t}$ for the post-crisis sample period (Jan. 2010 - Jun. 2017).